Which of the two methods, then, is the more applicable to the data for discussion?

Of all the methods, that of the harmonic analysis is doubtless the best. It enables us to see whether there is any parallelism, and if there is a cycle, what is its probable length with respect to the sun-spot cycle, the range of variation, the times of maximum and minimum, with their intervals, &c. I have applied this method to yearly values of the rainfalls, and of the levels of rivers of various countries, and have come to the conclusion that, notwithstanding all apparent irregularities, there is an intimate connection between sun-spots and rainfall.

If the rainfall generally was above its mean in the years of maximum sun-spot, and below it in the years of minimum sun-spot, we should get for the mean yearly rainfall of a number of stations the equation $\frac{S-s}{s'-S}=\frac{R-r}{r'-R}$, where S is the mean value of the sun-spots for the period examined, s the mean value of the spots when below S, s' their mean value when above S, and R, r, r' the corresponding values for the rain for the years from which S, s, and s' were obtained. This formula applied to the public observations of different countries shows that with very few exceptions the rainfall for the periods examined were above the average. The results for the mean rainfall of fifty-four stations in Great Britain, and thirty-four in America from 1824 to 1867 are as follows:—

Great Britain ... ...
$$\begin{cases}\frac{S-s}{s'-S}=\frac{24\cdot9}{29\cdot8}=\cdot8356\\ \frac{R-r}{r'-R}=\frac{+0\cdot75}{+0\cdot90}=\cdot8333\end{cases}$$

America ... ...
$$\begin{cases}\frac{S-s}{s'-S}=\frac{24\cdot9}{29\cdot8}=\cdot8356\\ \frac{R-r}{r'-R}=\frac{+0\cdot94}{+1\cdot13}=\cdot8407\end{cases}$$

In other words, the rainfall of fifty-four stations in Britain from 1824 to 1867 was 0·75 inch below the mean when the sun-spots were below their mean and 0·90 inch above it when the spots were in excess, and the corresponding values for America were 0·94 and 1·13 inch.

C. MELDRUM

Sun-spots and Weather

IN NATURE, vol. xvii. p. 326, Dr. Balfour Stewart concludes an article with the following remark:—

"It is nearly, if not absolutely, impossible from observations already made, to tell whether the sun be hotter or colder as a whole when there are most spots on his surface. The sooner we get to know this the better for our problem."

The Bombay barometric observations appear to me to afford fairly conclusive evidence in favour of the sun being hottest about the time of maximum spotted area, and coldest when the spotted area is at its minimum.

It is well known that in Central Asia the annual variation of the barometric pressure is greater than in any other portion of the globe, and it is universally admitted that this variation is due to the great variation of temperature between summer and winter, the barometer being low when the temperature is high, and *vice versâ*. If, therefore, the absolute heat of the sun is subject to considerable variations, we ought to find the barometric pressure in Central Asia responding to those variations just as it does to the annual variations of temperature; in other words, the summer barometric minimum should be lowest in those years when the sun is hottest, and the winter maximum should be highest in those years when the sun is coldest.

Similar results should be obtainable from the barometric records of any station where the annual variation of pressure is considerable and of the same character as in Central Asia. Bombay is such a station, and one where cyclonic disturbances are less frequent and violent than at most other Indian coast stations. I give below the mean barometric pressure at Bombay for the summer and winter half-years from 1847 to 1877:—

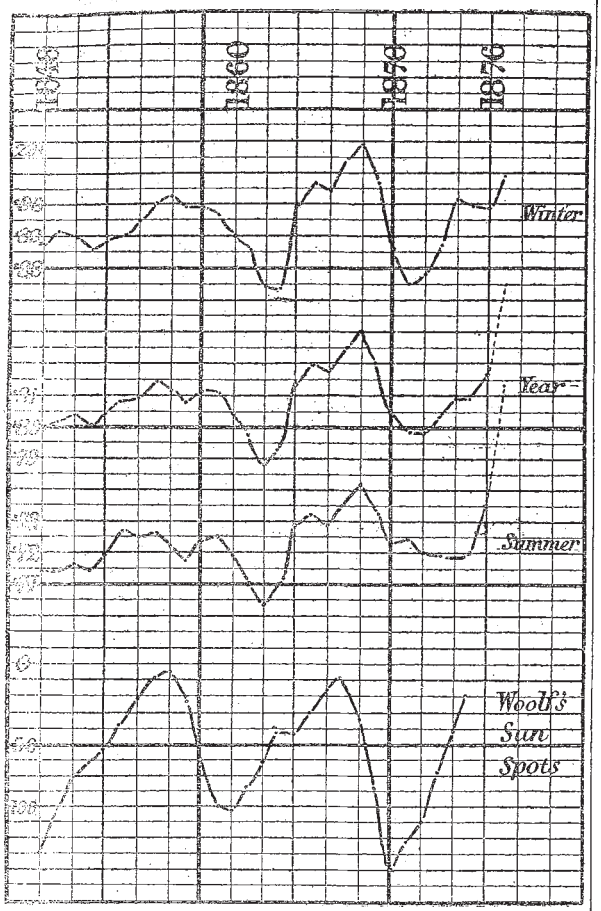
Mean Barometric Pressure at Bombay.

October to March.	1847–48.	1848–49.	1849–50.	1850–51.	1851–52.	1852–53.	1853–54.	1854–55.	1855–56.	1856–57.	1857–58.	1858–59.	1859–60.	1860–61.	1861–62.	1862–63.
	29+·884	29+·888	29+·894	29+·886	29+·888	29+·891	29+·891	29+·897	29+·905	29+·901	29+·898	29+·901	29+·894	29+·886	29+·886	29+·862
	1863–64.	1864–65.	1865–66.	1866–67.	1867–68.	1868–69.	1869–70.	1870–71.	1871–72.	1872–73.	1873–74.	1874–75.	1875–76.	1876–77.	1877–78.	—
	29+·885	29+·912	29+·902	29+·906	29+·925	29+·913	29+·903	29+·872	29+·879	29+·878	29+·897	29+·906	29+·893	29+·903	29+·916	—
																—
April to September.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.
	29+·707	29+·722	29+·703	29+·730	29+·704	29+·719	29+·737	29+·712	29+·743	29+·712	29+·718	29+·723	29+·729	29+·722	29+·707	29+·705
	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	—
	29+·698	29+·751	29+·720	29+·738	29+·722	29+·760	29+·726	29+·721	29+·731	29+·713	29+·725	29+·713	29+·722	29+·723	29+·773	—

The winter means correspond in time to the beginning of each year, the summer means to the middle of each year. Taking the mean of each pair of winter means, we obtain a new set of numbers which correspond to the middle of each year, and which give a somewhat smoother curve than the original numbers, and performing a similar operation twice upon the summer means, we obtain a similarly smoothed set of numbers also corresponding to the middle of each year. These two sets of smoothed numbers, and their means, are given below, and graphically represented by the accompanying curves, along with the inverted sun-spot curve.

—	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.
Winter	29+·886	29+·891	29+·890	29+·887	29+·889	29+·891	29+·894	29+·901	29+·903	29+·899	29+·899	29+·897	29+·890	29+·886	29+·874
Summer	·713	·714	·716	·714	·719	·726	·725	·727	·721	·717	·723	·725	·719	·710	·703
Year	·799	·802	·803	·800	·804	·808	·809	·814	·812	·808	·811	·811	·804	·798	·788
—	1863.	1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.
Winter	29+·873	29+·898	29+·907	29+·904	29+·915	29+·919	29+·908	29+·887	29+·875	29+·878	29+·887	29+·901	29+·899	29+·898	29+·909
Summer	·712	·729	·732	·729	·735	·742	·733	·724	·724	·720	·719	·718	·719	·735	[·773]
Year	·792	·813	·819	·816	·825	·830	·820	·805	·799	·799	·803	·809	·809	·816	[·845]

It will be seen that there is a remarkable degree of resemblance in the progression of these phenomena from year to year, but that the barometric curve "lags behind" the sun-spot curve, particularly in the years of maximum sun-spots.



The winter curve is more regular than the summer one, probably because the weather generally in India is more settled in the winter than in the summer, but on the whole the two curves support each other in showing a low pressure about the time of sun-spot maximum, and a high pressure at the time of sun-spot minimum. We may therefore conclude that the sun is hottest about the time when the spots are at a maximum, and coldest when they are at a minimum.

The range of the variation of the year by mean pressure from the minimum of 1862 to the maximum of 1868, is ·042 of an inch, and the mean range of the barometer from January to July is ·291, from which it appears that the variations of pressure produced by absolute variations of the sun's heat are, in comparison with the usual seasonal changes, by no means insignificant.

These results appear to harmonise well with the decennial variations of the rainfall in India, and to throw light upon the inverse variation (compared with the sun-spots) of the winter rainfall of Northern India. Mr. Archibald has attempted to explain this latter phenomenon on the assumption that the sun is coldest when it is most spotted, but the inverse winter variation of the rainfall of Northern India, as well as the direct variation at Madras, Bombay, Trevandrum, and elsewhere, appear to me to follow more naturally from the contrary view; for if the winter rainfall in Northern India is really due to the cold of winter we should expect it to be greatest when the sun is coldest, just as the summer rainfall is expected to be greatest when the sun is hottest. FRED. CHAMBERS

Bombay, August 23

The Norwegian Arctic Expedition

THE *Vöringen*, Capt. Wille, returned to Christiania on the 10th, from Spitzbergen, after a most successful cruise. No less than 375 stations have been thus explored by sounding, dredging, and trawling during the last three summers; and the *Morgenbladet* reminds us that only 354 of such stations were recorded in the notice of the *Challenger* expedition. The number of stations in the *Porcupine* cruises of 1869 and 1870 was 148.

Prof. G. O. Sars informs me that in every department of zoology a vast amount of material was procured in his last cruise, and that especially the Mollusca are abundantly represented, not only by magnificent specimens of rare Arctic species, such as *Fusus krøyeri* and *F.* (*Neptunea*) *deformis*, but also by several interesting new forms. He adds that the conchological collection from this cruise is indeed much richer than both of those made in his former two cruises. Herr Friele will work out all the Mollusca.

I cannot omit expressing my admiration of the recent work of Prof. G. O. Sars, entitled "Mollusca Regionis Arcticæ Norvegiæ." His descriptions are excellent, and his figures (all by his own hand, and autographed) are inimitable. The work contains 466 pages and 52 plates, besides a chart.

Ware Priory, Herts, September 23 J. GWYN JEFFREYS

Albinism in Birds

WHEN I was forming the Government Central Museum at Madras, an albino crow was brought to me, which was stuffed and placed in the museum. It was mentioned to me at the same time that there is a colony of albino crows at a part of the Malabar coast, but I have never been able to verify the statement. That district is daily becoming more frequented by Europeans, and some of them may soon be in a position to ascertain how far the report was correct. EDWARD BALFOUR

2, Oxford Square, September 19

As Mr. Page says, in NATURE (vol. xviii. p. 540), he has only heard of one white swallow, it may be interesting to him and your readers to learn that in the Newcastle Museum there is a specimen, also white specimens of the rook, pheasant, curlew, sparrow, and starling; in the same collection will also be found a "pale rose" coloured specimen of the bullfinch.

Newcastle-upon-Tyne, September 20 WM. LYALL

"Hearing of Insects"

I AM able to confirm the accounts given by Mr. Simson in your last number as to the probability of the hearing of insects. When travelling on the River Magdalena, New Granada, in 1861, the mode of which is by a long boat, arched over with bamboo, on which the sailors (bogas) passing from one extremity to the other, propel it with long poles, hugging the river bank, accompanied with wild cries and execrations, I observed on several occasions that these cries suddenly ceased, a dead silence following, and on inquiring the cause they pointed to nests high up in the trees, whispering the word vispa (wasp). As the bogas pursue their avocations in a state of semi-nudity, they have the greatest dread of these insects, fearing to speak aloud, as their only alternative if attacked by them is to plunge into the stream, where alligators abound. The wasp is long, slender, and black in colour.

117, Cromwell Road, S.W., Sept. 21 W. L. DUDLEY

The Meteor Shower of Andromedes I.

MR. GREG'S meteor radiant (No. 103 of his 1876 catalogue) at R.A. 7°, Dec. 33° N., for July 21 to August, really consists of two well-defined showers near α Andromedæ. The meteors are quite distinct, and, moreover, there is a difference of 10° in declination. My observations since 1873 indicate two positions as below:—

I. July 6 to August 16, 6° + 37°. { 60 very swift streak-leaving meteors.

II. July 6 to August 11, 3° + 27° { 23 slow, bright, trained meteors.

Schiaparelli and Zezioli, Greg and Herschel, and Tupman, found the former some years ago, and Denza gives the latter at 2° + 29° August 8–13. Mr. Greg averages these with several others (including one by Schmidt at 7° + 30°, and another by Heis at 11° + 30°, both for August) and finds a centre at 7° + 33° for the whole. There is no doubt, however, that there are *two* conspicuous contemporary radiants of entirely